

# Human Physiology

# Homeostasis



**Body - constant environment  
(optimum level).**

## **Homeostasis:**

The process by which a stable internal environment is maintained despite changes in the external environment.

### **Important variables within the body:**

- blood sugar
- fluid balance
- body temperature
- oxygen levels
- blood pressure
- pH

These variables must stay within certain ranges.

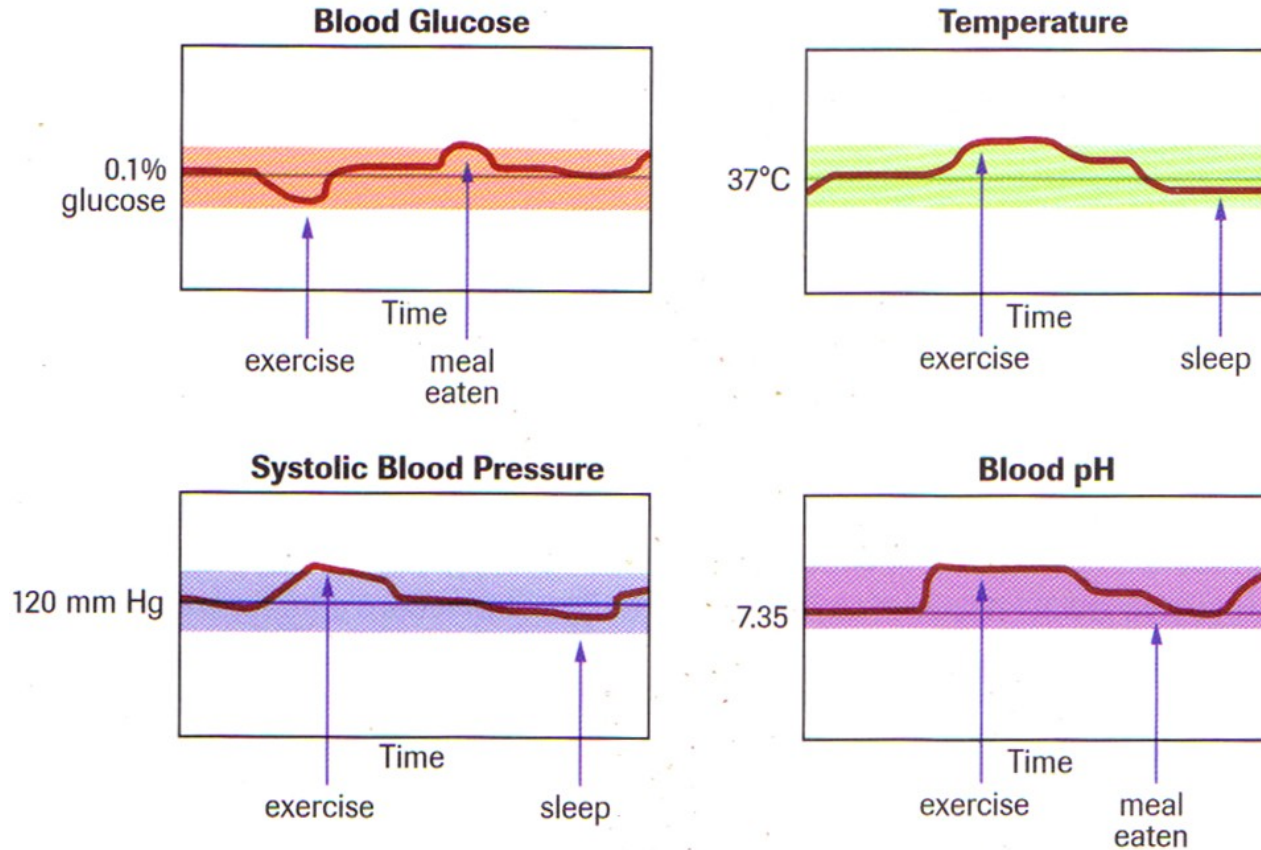
Changes in the external environment can cause these variables to change.

# Components of a homeostatic control system:

Component	Function
<b>Receptor(Sensor)</b>	detects a change in variable
<b>Co-ordinating centre</b>	receives a message from the receptor(sensor). directs a response via a regulator.
<b>Regulator</b>	carries out the response initiated by the co-ordinating centre

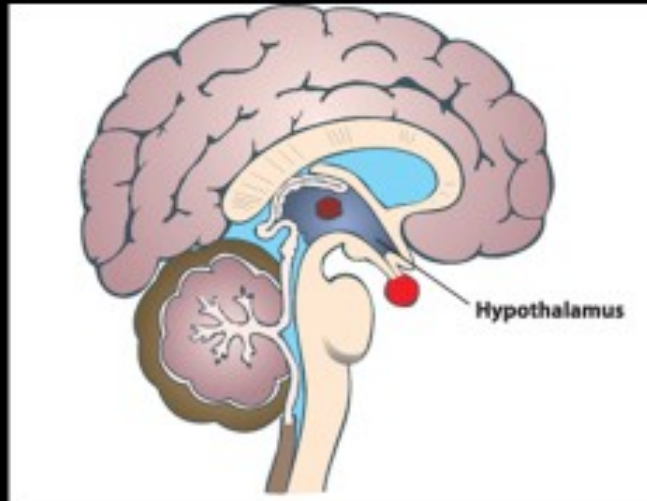
# Dynamic equilibrium

- Homeostasis is also called **dynamic equilibrium**:



- Conditions *do* fluctuate, but within an acceptable range

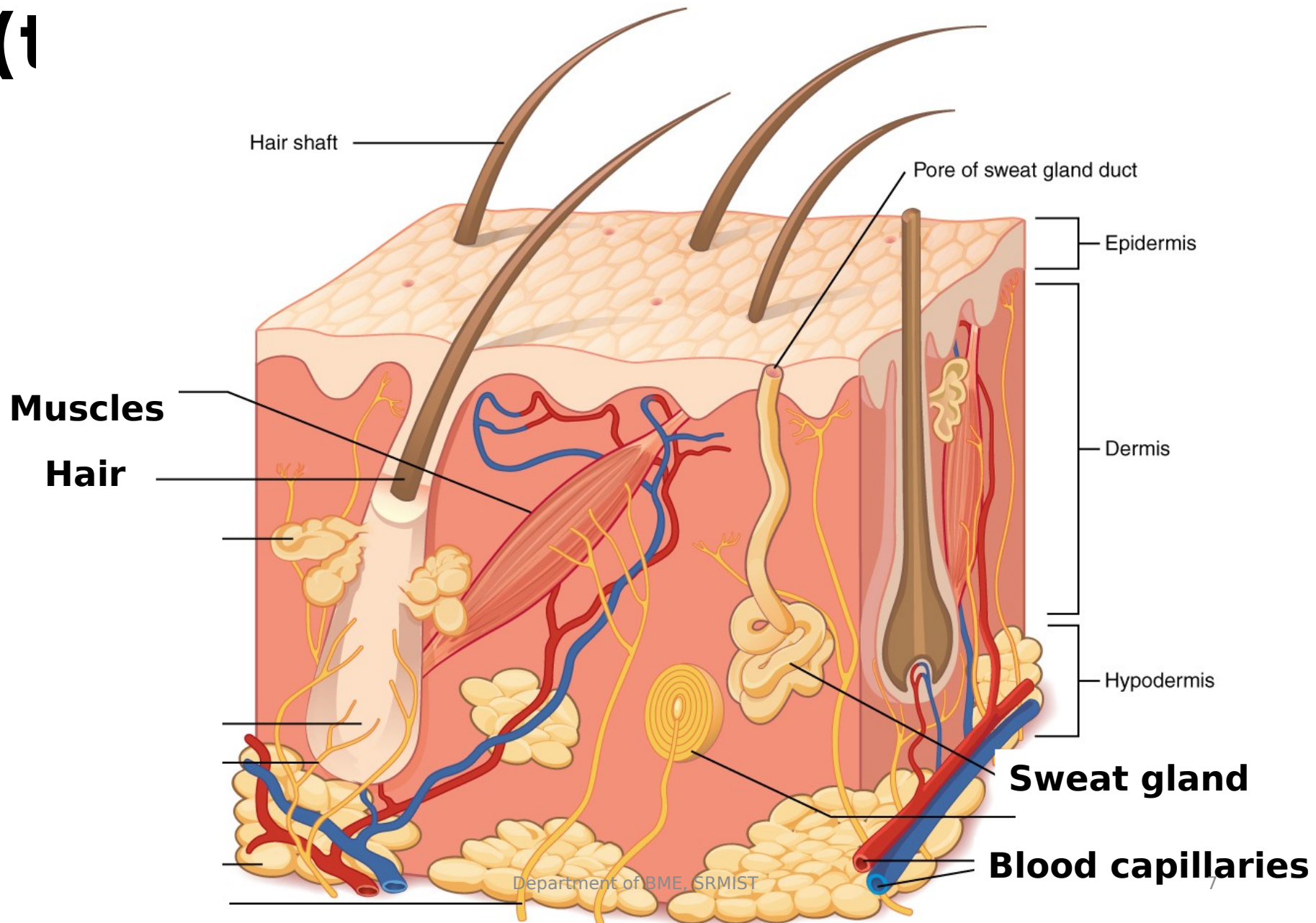
Organs that contribute to homeostasis are:



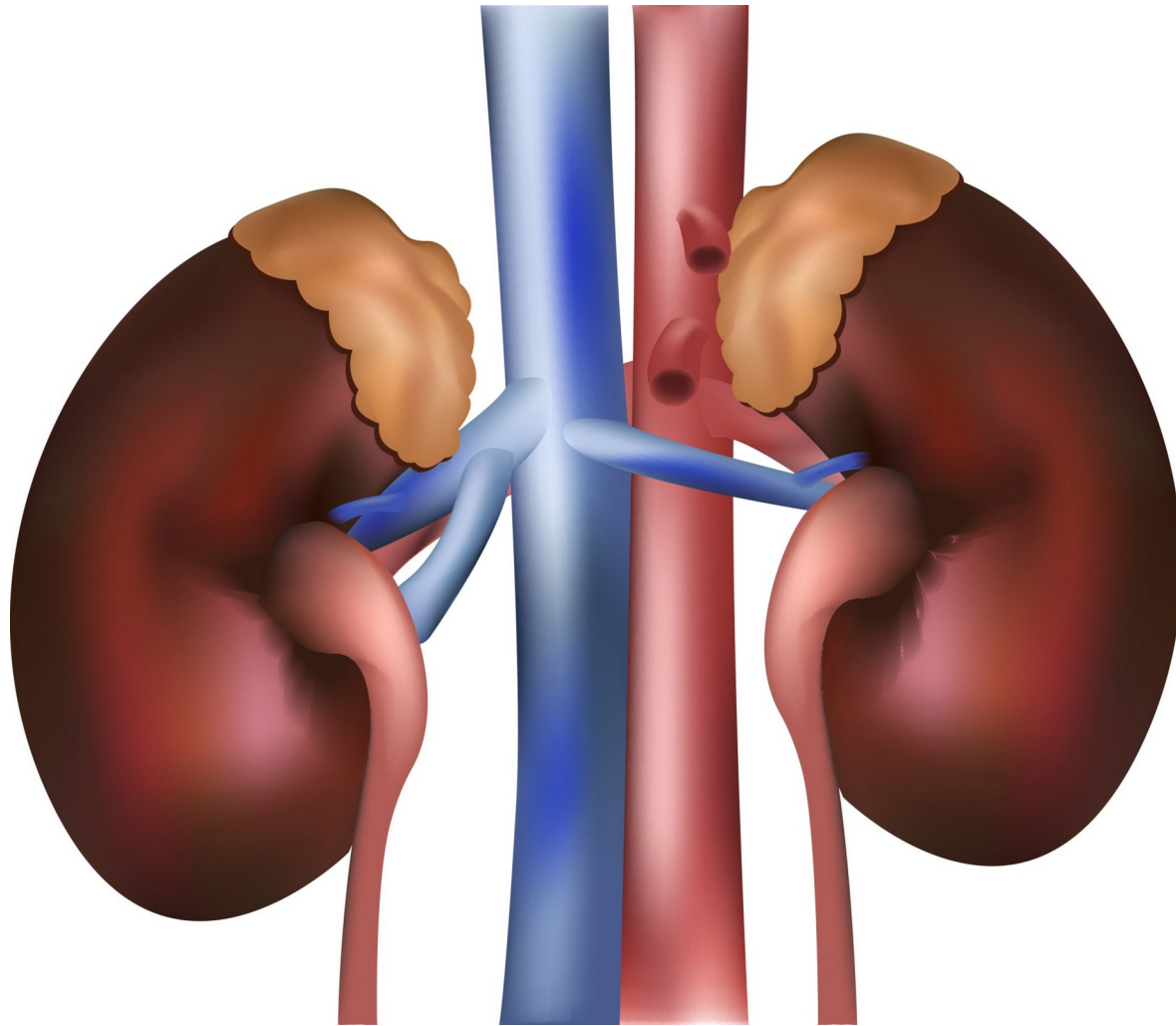
The brain  
(hypothalamus).

# Skin

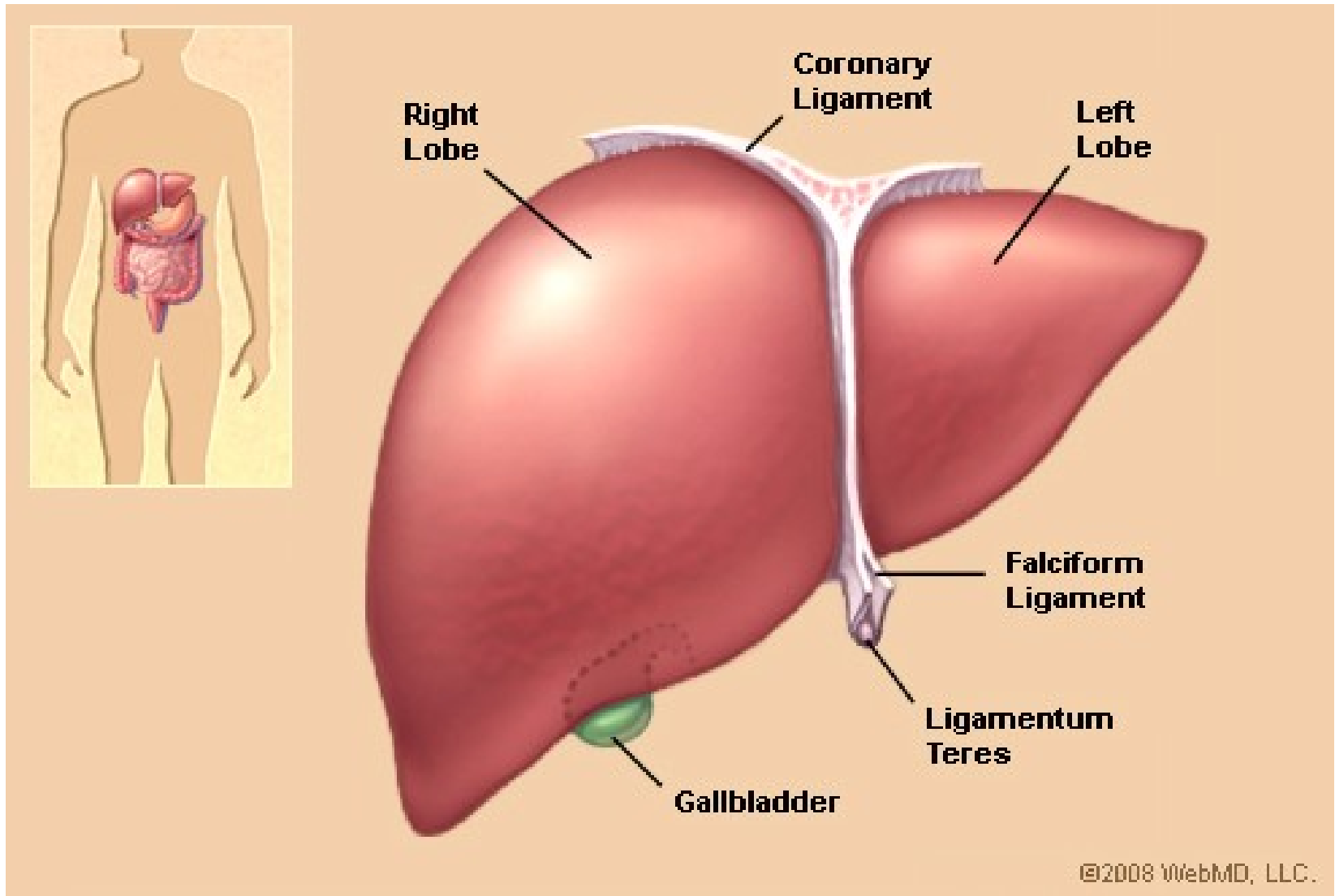
(1)



# kidneys (osmoregulation)

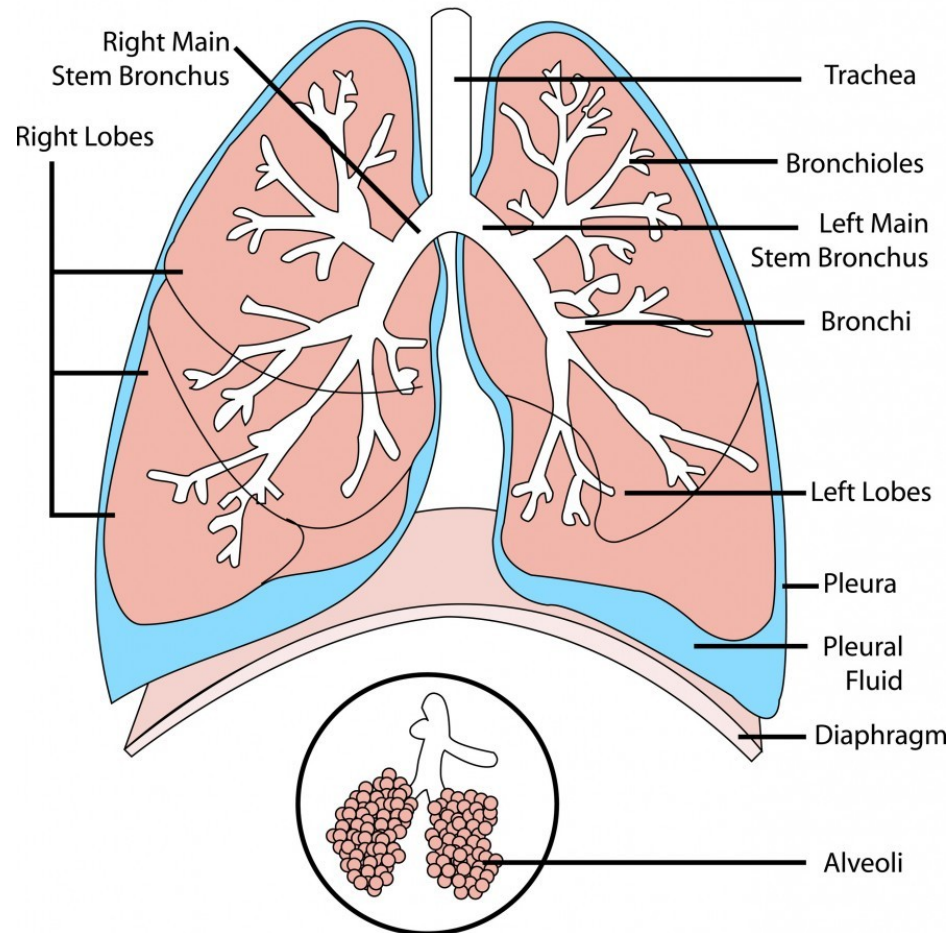


# Liver (glucose levels)



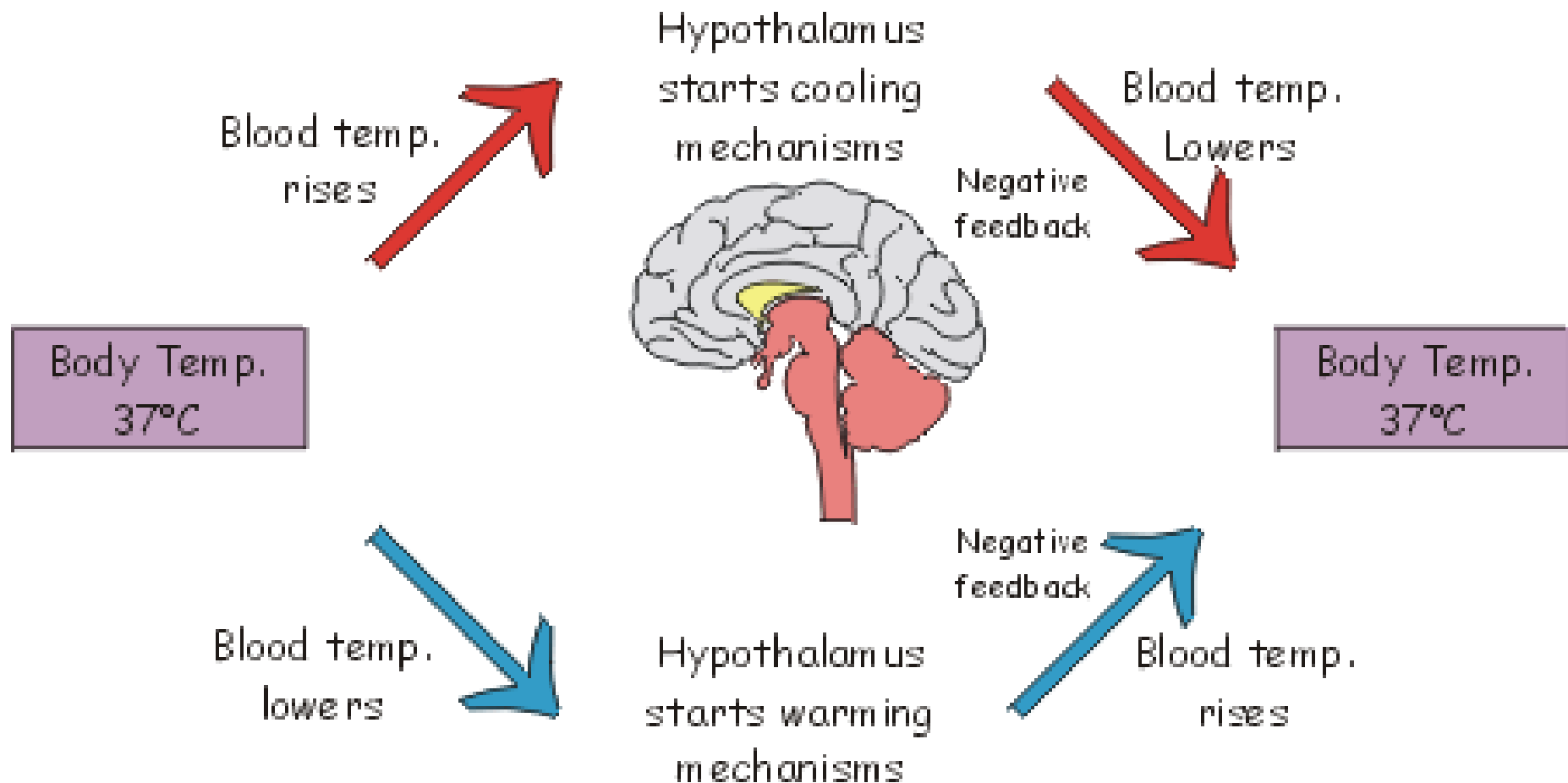
# Lungs (oxygen and CO<sub>2</sub> levels)

Diagram of the Human Lungs



- How is dynamic equilibrium maintained?
- Feedback systems
  - Negative feedback
  - Positive feedback

# Negative feedback



# Positive feedback

- **Positive feedback:** The response triggered by changing conditions serves to move the variable even further away from its steady state
- E.g., uterine contractions are stimulated by oxytocin → baby moves towards cervix → more oxytocin is released



# Balancing glucose

After a meal the pancreas releases insulin which converts the glucose into glycogen which is stored in the liver.

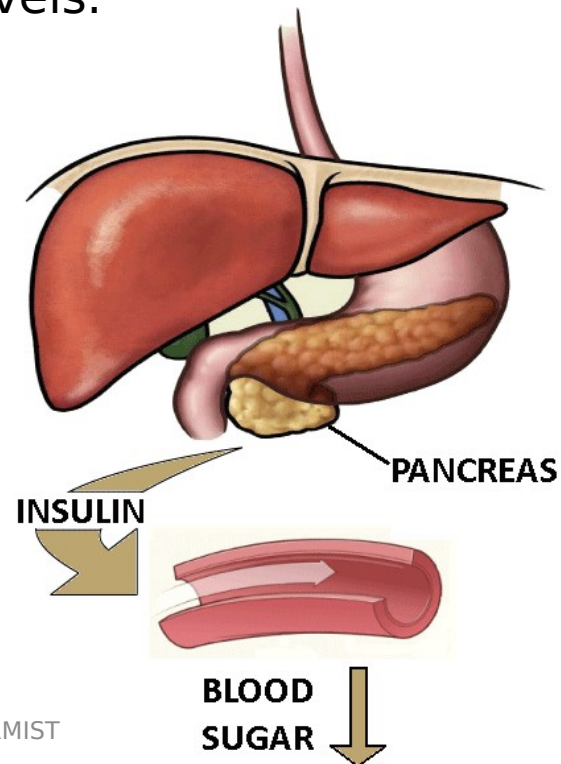
When the glucose in the blood begins to fall the liver converts some of the glycogen back to glucose and releases it into the blood to keep the amount of glucose in the blood at the

same levels.

The liver and the pancreas regulate the amount of glucose in the blood.

**A very low blood glucose level results a coma and death.**

**Organs involved are the liver and pancreas...and the brain.**



# Osmoregulation (water balance)

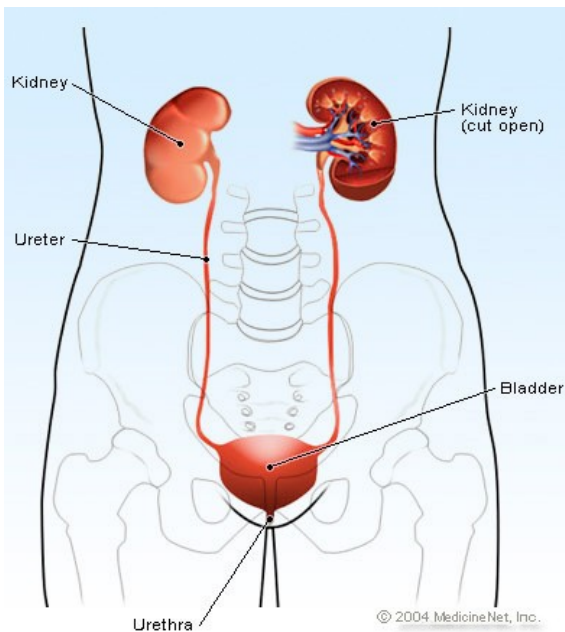
**Organs involved  
are:**

**Brain, kidneys and  
bladder**

The changes in the concentration of blood are detected in the part of the brain called the hypothalamus.

**If the blood is too dilute the hypothalamus will stop producing ADH and less water is reabsorbed back into the blood.**

If the blood is too concentrated the hypothalamus will produce more ADH so a lot of water will be reabsorbed back into the blood.



# Temperature regulation

s involved: Brain (hypothalamus) and

If the temperature

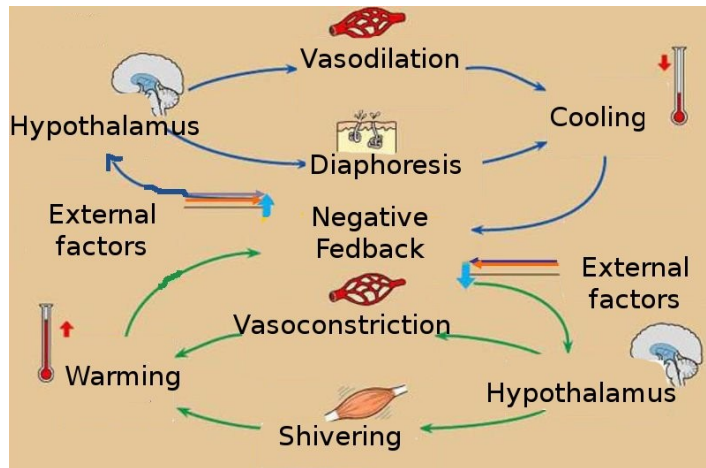
**INCREASES** then

nerve messages get sent to the skin and it responds in two ways: vasodilatation and sweating.

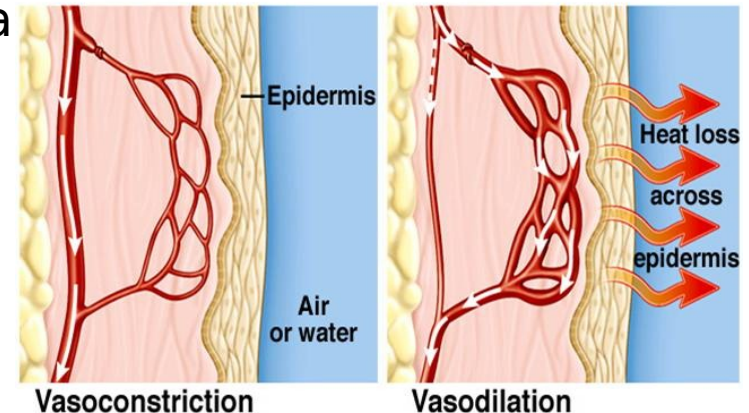
If the temperature

**DECREASES** then nerve

impulses get sent to the skin and it responds by: vasoconstriction, goose bumps a



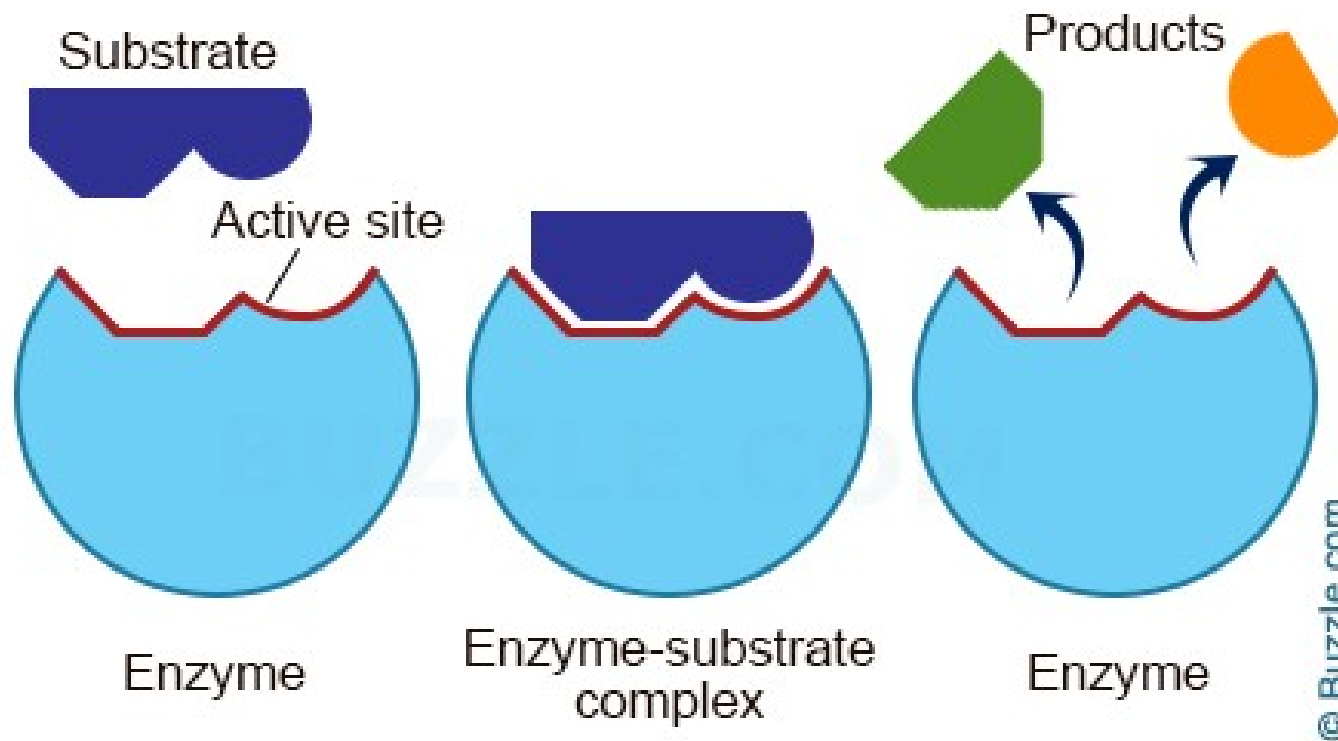
Having a steady body temperature at 37 degrees ensures that all the chemical reactions can take place at an optimum rate in the body and sustain life





**Homeostasis is important because adverse conditions can..**

**prevent an enzyme from working and  
prevent an important **reaction** from  
taking place inside a cell.**



## Recap Points:

- The definition of homeostasis: the body is maintained as constant environment, the concentrations of substances, the levels of fluid and the temperature are maintained at optimum levels. These include:
  - The concentration of glucose, sodium and other minerals.
  - The level of water.
  - The pH of the fluids.
  - The temperature.
  - The concentrations of nutrients.
  - The concentrations of waste materials below a certain level.
- Homeostasis is important because a slight fall in temperature or change in the concentration of a substance or liquid could prevent an enzyme from working and prevent an important reaction from taking place inside a cell.
- If the concentration of body fluid was too great water would withdraw from cells and important reactions would not take place.

## Recap Points:

- Organs that contribute to homeostasis are: brain (hypothalamus), skin (temperature), kidneys (osmoregulation), liver (glucose levels) and lungs (oxygen and CO<sub>2</sub> levels).
- The liver regulates the amount of glucose in the blood.
- After a meal the liver converts the glucose into glycogen and stores it.
- When the glucose in the blood begins to fall the liver converts some of the glycogen back to glucose and releases it into the blood to keep the amount of glucose in the blood at the same levels.
- A very low blood glucose level results a coma and death.
- The kidneys balance the amount of water in the blood.
- If the blood is too dilute then less water is reabsorbed back into the blood as it goes through the nephrons. In this case the urine will be clear in colour.

## Recap Points:

- If the blood is too concentrated then a lot of water will be reabsorbed back into the blood as it passes through the nephron and the color of the urine will be dark yellow.
- The rise in blood concentration stimulates the thirst part of the brain.
- This regulatory process is known as osmoregulation.
- The changes in the concentration of blood are detected in the part of the brain called the hypothalamus.
- The hypothalamus releases a hormone called ADH (anti diuretic hormone) into the blood when the blood concentration rises.
- This hormone makes the renal tubules absorb more water from the glomerular filtrate back into the blood.
- If the blood concentration becomes too dilute then the production of ADH is stopped.

## Recap Points:

- Temperature regulation is an example of homeostasis.
- Having a steady body temperature at 37 degrees ensures that all the chemical reactions can take place at an optimum rate in the body and sustain life.
- The hypothalamus is also the temperature centre of the brain.
- If the temperature increases then nerve messages get sent to the skin and it responds in two ways: vasodilatation and sweating.
- If the temperature falls then nerve impulses get sent to the skin and it responds by: vasoconstriction and shivering.
- This response is called negative feedback. This means that there is only a response by the body when something is not right i.e. the temperature falls or the glucose levels drop

# Websites for extra reading...

<http://www.youtube.com/watch?v=62e8IV-WT8c>

<http://www.youtube.com/watch?v=1iPndNB7mjw>

<http://www.youtube.com/watch?v=QKT47A-LBj4>

<http://www.youtube.com/watch?v=0kxsviCkS40>